Internal migration and economic complexity in Brazil:
Exploring migration of high-skilled workers towards economic complex locations

Authors: Tim Balemans[1]; Héder Carlos de Oliveira[2]; Ana Carolina da Cruz Lima[3]

[1] Master in Economics at University School of Economics (U.S.E.)/Utrecht University, Netherlands.

[2] Senior Lecturer at the Department of Economics and the Master Program of Applied Economics at Federal University of Ouro Preto – UFOP/Brazil. Email contact: hedercarlos@yahoo.com.br

[3] Senior Lecturer at the Departamento de Evolução Econômica (DEE) at Rio de Janeiro State University.

In the past century, industrialization determined the migration destination of people in Brazil: the population movements were caused due to the trajectories that were imposed by the transformations taking place in Brazil's economy (Sessao, 2001). According to Vainer & Brito (2001), industrialization created new jobs in the country and led to huge urbanization processes. People from the countryside migrated to the big cities as there would be more job opportunities and higher income possibilities, increasing Brazil's urban population rapidly in only a few decades. Before the 1950's, the Brazilian urban network was only starting and at the roots of its expansion. The most populated urban areas at the time were in the states of São Paulo and Rio de Janeiro, where infrastructure was adapted to the size and growth of the urban population. Da Cruz Lima et al. (2016) state that there was a strong turning point at the 1950's, during which the expansion started to emerge. Migration trajectories from here on have been fundamental for Brazilian market development as Vainer and Brito pointed out (2001), because between 1950 and 1960 urban growth rates throughout the whole country increased rapidly with approximately 5.3% a year.

Martine and McGranahan (2010) leds to the fact that in 1950 only 36% of Brazil's population lived in cities, whereas in 1960 that was 45%. From the 1960's onwards,

industrialization played a huge role in Brazil's migration patterns in a way that it brought along a variety of new jobs which were mainly located in the cities and not in the countryside (Focus Migration, 2008). The main pull-factor for Brazilian people was formed by the job opportunities, coming along with a push-factor, as the peasant population was suffering from increasing poverty rates. Amaral (2013) states that job opportunities for the peasant population decreased because of strong population growth and the industrialization of agriculture.

Apart from internal migration theories, Hidalgo & Hausman (2009) introduced the concept of economic complexity, stating that the wealth of a nation is connected to its production structure: the set of products and services that a nation can deliver. In practice this means that the products that a country is able to produce are more important than the extracted value of these products, as products have different levels of sophistication. These sophistication levels define the income of a country or a city, along with the variety of products that a country or city makes, decreasing the importance of the traded value of its exports. The production framework of countries or cities exists of local input availability that can be used for production, which Hidalgo and Hausman (2009) name 'capabilities': specific building blocks of production. Both tangible (airports, harbors) as intangible (skill, networks) inputs form capabilities and in order to produce certain products, a country or city needs the capabilities that are locally available. The more capabilities are needed to produce a certain product, the higher the sophistication level and economic complexity is derived from the available capabilities a country or city has.

In that sense, the research question is used to find what the probability is of migration of high-skilled workers in Brazil in 2005 to an economic complex location in Brazil in 2010, using logit estimations for the empirical analysis, according to a model with variables that are constructed from the IBGE Census 2010 and economic complexity indices from FAPEMIG (2015). The specification between high- and low-skilled workers is made, to explore which group of workers has the highest probability to migrate internally to complex cities in Brazil.

In order to answer the research question five hypotheses are tested. The first hypothesis tests whether people who are living in more complex cities in Brazil have a higher probability of migrating to another complex city in Brazil. It is expected that the probability of migration of people who live in a complex city to another complex city is higher than the probability of migration of people who do not live in a complex city

already. The higher human capital stock and knowledge spillovers in complex cities are forming the explanation of this expectation, as externalities can improve a country's technological progress and therefore stimulate economic growth (Lucas, 1988; Romer, 1990). Schumacher et al. (2011) agree, stating that positive externalities arise from human capital and knowledge spillovers among others. The second hypothesis tests if high-skilled workers have a higher probability of migrating to an economic complex city than low-skilled workers. This paper expects that there is a higher probability of migration to economic complex cities for high-skilled workers than for low-skilled workers, as more complex cities require more capabilities of workers, so for workers more human capital is needed specifically (Hidalgo & Hausman, 2009). To give a complete profile of the high-skilled workers, a specification of high-skilled workers is made: an analysis is constructed to test whether workers with graduation, a master's degree or a PhD have the highest probability of migrating to an economic complex location. Furthermore, this paper aims to show in which occupational field the high-skilled workers with the highest probability of migrating to an economic complex location is active. The third hypothesis tests whether high-skilled young workers have a higher probability of migration to an economic complex location than high-skilled older workers. The fourth hypothesis tests whether high-skilled females have a higher probability of migrating to an economic complex cities than high-skilled males. Finally, the fifth hypothesis tests whether white high-skilled workers have a higher probability of migrating to an economic complex location than high-skilled workers with another skin color.

The first estimations that followed from the regressions showed that people who already lived in an economic complex city in 2005 had a higher probability of migrating to another economic complex city in 2010 than people who did not live in an economic complex city in 2005. Also, low-skilled workers (at most completed high school) have a lower probability of migrating to an economic complex city than high-skilled (at least graduated) workers. As economic complex cities require high capabilities to produce complex and sophisticated products, human capital requirements are high as well. High-skilled workers therefore are more wanted in these cities, making it more likely for high-skilled workers to migrate towards economic complex cities.

The control variables that were used for these first estimations were age, sex, skin color (race), and income levels, in line with previous literature on internal migration in Brazil. Results showed that high-skilled young people are more likely to migrate to

economic complex cities than high-skilled old people are. Also, high-skilled males have a higher probability of migration towards economic complex cities than high-skilled females. Gender discrimination might still play a role in this matter. The final control variable in the first estimations, which is skin color, showed that white people are more likely to migrate to an economic complex city than other skin colors (brown, black, yellow and indigenous) and brown people have a lower probability of migrating to an economic complex city than other skin colors (white, black, yellow and indigenous).

After the first estimations, this research aimed to zoom in on the probability of migration of high-skilled workers towards economic complex cities. In the second model, high-skilled workers were divided between people who are graduated, have a Master's degree, or a PhD. Empirical results showed that graduated high-skilled workers have a lower probability of migrating towards an economic complex city than workers with a PhD. The probability of migration of a high-skilled worker with a Master's degree however, is slightly higher than the probability of migration of PhD's. High-skilled workers with a Master's degree seem therefore to have sufficient knowledge to be integrated in an economic complex city's environment.

Finally, a third model was constructed to explain in which educational area the probability of migration of high-skilled workers to economic complex cities was highest. Empirical results showed that high-skilled workers from the fields of the social sciences, business, and law school, as well as high-skilled workers from areas as engineering, construction, and production industries are more likely to migrate to economic complex cities than the people who are in other study areas. Especially the high-skilled workers who are active in engineering, construction and production show a highly positive significant coefficient, which could be explained in the way that engineering, construction, and production industries are all requiring high capabilities in the work fields of economic complex cities. Studying internal migration patterns is of importance as national and regional policymakers could get more understanding of the internal migration patterns towards economic complex locations and use the findings of this paper to steer internal migration in Brazil.

From a societal perspective this research contributes to improving the understanding of the determinants of internal migration to economic complex cities in Brazil. This better understanding helps regional as well as national policy makers in their decision-making of migration policies, which could lead to more economic growth of the

country. As internal migration in Brazil is responsive to earning differences, internal migration policies could contribute to economic growth. The research found that economic complex cities attract high-skilled workers more than low-skilled workers, which benefits the economic complexity indices of these cities. As economic complexity is a measure of economic growth, this phenomenon of high-skilled migration towards economic complex cities can be seen as growth-enhancing.

Implications of this research can be used by regional as well as national policy makers, as migration decisions can be overviewed. Migration of high-skilled workers for instance can bring human capital externalities to certain regions (Borjas, 2016). On the other hand, the regions of origin could suffer economically from outmigration of high-skilled workers (Docquier and Rapoport, 2012).